

Public Health Assessment

Final Release

NEW CARLISLE LANDFILL

NEW CARLISLE, CLARK COUNTY, OHIO

EPA FACILITY ID: OHN000509238

**Prepared by the
Ohio Department of Health**

MAY 17, 2012

Prepared under a Cooperative Agreement with the
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Agency for Toxic Substances and Disease Registry
Division of Community Health Investigations
Atlanta, Georgia 30333

THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

This Public Health Assessment was prepared by ATSDR's Cooperative Agreement Partner pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) section 104 (i)(6) (42 U.S.C. 9604 (i)(6)), and in accordance with our implementing regulations (42 C.F.R. Part 90). In preparing this document, ATSDR's Cooperative Agreement Partner has collected relevant health data, environmental data, and community health concerns from the Environmental Protection Agency (EPA), state and local health and environmental agencies, the community, and potentially responsible parties, where appropriate.

In addition, this document has previously been provided to EPA and the affected states in an initial release, as required by CERCLA section 104 (i)(6)(H) for their information and review. The revised document was released for a 60-day public comment period. Subsequent to the public comment period, ATSDR's Cooperative Agreement Partner addressed all public comments and revised or appended the document as appropriate. The public health assessment has now been reissued. This concludes the public health assessment process for this site, unless additional information is obtained by ATSDR's Cooperative Agreement Partner which, in the agency's opinion, indicates a need to revise or append the conclusions previously issued.

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NEW CARLISLE LANDFILL SITE

SUMMARY

Introduction In 2005, United States Environmental Protection Agency's (USEPA) Region 5 Emergency Response Branch requested that the Health Assessment Section (HAS) evaluate available environmental sampling data to determine potential health impacts to the community posed by the elevated levels of vinyl chloride in groundwater underlying commercial and residential properties in the New Carlisle area of Clark County, Ohio (Figures 1 and 2). The Ohio Environmental Protection Agency (Ohio EPA) requested assistance from the USEPA and the HAS to carry out a time-critical investigation in the neighborhood to address these concerns. The Ohio EPA had been periodically monitoring groundwater and sampling the water from a non-community public water supply well servicing the main office of a local commercial nursery since 1993. The presence of vinyl chloride in the water in this well caused the Ohio EPA to issue an order to the property owner to cease use of this well as a drinking water supply. This well was replaced by a new public supply well in 2003. In 2006, the HAS determined that vinyl chloride levels were elevated above the federal drinking water standards in both the old and new public water supply wells and posed a public health hazard to on-site residents and workers at the nursery who used these wells as drinking water supplies (ATSDR, 2006). As part of a Time-critical Removal Action, the USEPA Emergency Response Branch installed a public water supply line to the nursery office and the two residences in October 2005 (ATSDR, 2006). The Ohio EPA is concerned that the groundwater contamination might impact the nearby semi-rural residential community in the vicinity of the landfill that is dependent on private wells for their drinking water supply. Two non-community public water supply wells at the Scarff's Nursery plus two private residential wells that provided water to two on-site residences at the nursery eventually were found to be contaminated with vinyl chloride in 2006. The former public wells are now used for irrigation, whereas the two residential wells were disconnected and are no longer used (Ohio EPA, 2006).

Groundwater investigations conducted by the Ohio EPA and USEPA (Ohio EPA, 2006 and USEPA, 2008) demonstrated that the New Carlisle Landfill site was the source of vinyl chloride groundwater contamination in the public water supply wells at the commercial nursery. In order to further characterize the source of groundwater contamination at the landfill and the full extent of down-gradient groundwater contamination, the Ohio EPA proposed the New Carlisle Landfill site for the National Priorities List (NPL) in September 2008. The site was then placed on the NPL in April 2009. The HAS was also asked to comment on the potential future public health threat to residents down-gradient of the New Carlisle

Landfill Site who use their wells for a drinking water supply.

The Health Assessment Section (HAS) of the Ohio Department of Health (ODH) has had a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR) since 1990. Under that agreement, the HAS undertook the lead in completing this public health assessment. This health assessment document evaluates the environmental data collected by the Ohio EPA and the USEPA as part of the groundwater investigation at this site. The HAS makes conclusions and recommendations for additional actions that may be necessary to protect public health.

Conclusion 1 The HAS reached a conclusion for people who drank groundwater with contaminants from the New Carlisle site in the past:

- In the past, drinking groundwater contaminated with vinyl chloride from public and residential wells at the nursery down-gradient of the New Carlisle Landfill for a year or longer could harm people's health. This was a public health hazard in the past; however, a safe alternative public water supply was provided by the USEPA in 2006, eliminating the exposure.

Basis for Decision

Groundwater data in the recent past indicated two public and two private water supply wells were contaminated with vinyl chloride, a known human carcinogen, at levels above the federal drinking water standard. Possible health problems for people drinking water contaminated with vinyl chloride for a year or longer are potential carcinogenic effects. Non-cancer effects are not expected at the low concentrations detected.

Next Steps To protect people:

- The USEPA Emergency Response Branch installed a water main and connections to the nursery and residences affected by the contaminated groundwater and connected these facilities to local public water supply.
- The source of the contamination, the New Carlisle Landfill site, was proposed and placed on the National Priorities List (NPL) of Federal Superfund Hazardous Waste sites.
- The USEPA Remedial Response Branch has started a Remedial Investigation/Feasibility Study (RI/FS) to investigate and eventually contain or cleanup the source of the groundwater contamination in the vicinity of the New Carlisle Landfill site.
- Groundwater in the area down-gradient of the New Carlisle Landfill site will be monitored to ensure that no additional public or private water supply wells become contaminated.

Conclusion 2 The HAS reached a conclusion for people drinking groundwater in the

area of the New Carlisle Landfill, currently or in the future.

- Currently, drinking groundwater from public or residential wells down-gradient of the New Carlisle Landfill is not expected to harm people's health.
- In the future, drinking groundwater from public or residential wells down-gradient of the New Carlisle Landfill may harm people's health.

Basis for Decision

- Groundwater monitoring data from 2007 indicates that the contaminants have not migrated beyond the nursery. Testing recently conducted on October 24, 2011 by the Clark County Combined Health District of the four down gradient private wells indicated no site-related VOCs were present. It is uncertain whether or not the plume is continuing to migrate and that down gradient wells are at risk. Continued monitoring of the plume and down gradient wells is necessary and will be conducted as part of the upcoming remedial investigation for the site.

Next Steps To protect people:

- The source of the contamination, the New Carlisle Landfill site, was proposed and placed on the National Priorities List (NPL) of Federal Superfund Hazardous Waste sites.
- The USEPA Remedial Response Branch has started a Remedial Investigation/Feasibility Study (RI/FS) to investigate and eventually isolate and contain or remove the source of the groundwater contamination in the vicinity of the New Carlisle Landfill site.
- Groundwater in the area down-gradient of the New Carlisle Landfill site will be monitored to ensure that no additional public or private water supply wells become contaminated.

Conclusion 3 The HAS reached a conclusion for residents and workers in the area of the New Carlisle Landfill:

- The HAS cannot currently conclude whether vapor intrusion of VOCs into nearby residences or businesses could harm people's health. The information needed to make a decision is currently not available. We are working with the USEPA to gather the needed information.

Basis for Decision

There is a potential of a completed indoor air pathway when comparing the maximum vinyl chloride concentration detected in groundwater at the nursery to the groundwater vapor intrusion guidance value. However, due to the increasing depth to the water table in this off-site area and the local

development of a low-permeability clay layer between the ground surface and the water table in this area, vapor intrusion is unlikely to be an issue off-site although there is only limited data currently available that can be used to eliminate this potential pathway.

Next Steps

To protect people:

- The shallow subsurface clay layer between the groundwater plume and residents and worker needs further characterization to determine if it provides sufficient barrier for the vertical migration of contaminated vapors into overlying structures.
- The USEPA Remedial Response Branch has started a Remedial Investigation/Feasibility Study (RI/FS) to investigate and eventually contain or cleanup the source of the groundwater contamination in the vicinity of the New Carlisle Landfill site.
 - Groundwater in the area down-gradient of the New Carlisle Landfill site will be monitored to ensure that no additional public or private water supply wells become contaminated.
 - The vapor intrusion pathway should be investigated further for residences and the commercial building on the landfill property and for buildings near the landfill.

For More Information

If you have any concerns about your health, as it relates to exposure to vinyl chloride you should contact your health care provider. You can also call the HAS at (614) 466-1390 and ask for information on the New Carlisle site.

STATEMENT OF ISSUES

The New Carlisle Landfill site, in New Carlisle, Clark County, Ohio, is a source of volatile organic compounds (VOCs) that are migrating off-site in the groundwater. Since 1993, the Ohio EPA had been reviewing sample results from down-gradient, non-community public water supply wells at a nearby retail and wholesale nursery (Figure 1). In 1997, levels of vinyl chloride were detected above the USEPA's primary safe drinking water standard, known as the Maximum Contaminant Level (MCL) (USEPA, 2009). In 2003, the nursery discontinued use of the well as a source of public drinking water and drilled a new well 750 feet to the south of the first well plus two new residential wells to provide water to the two families previously served by the former public well. By March of 2005, the new public well and one of the two private wells at the nursery also reported elevated vinyl chloride concentrations above the MCL. This led to Ohio EPA concerns that VOC's in the groundwater could also migrate to other residential wells immediately adjacent to the nursery. The Ohio EPA notified the USEPA and the HAS that the vinyl chloride was repeatedly detected in public water supply wells at the nursery just down-gradient of the New Carlisle Landfill site.

The HAS was asked by the USEPA Emergency Response Branch on May 16, 2005, to provide a public health consultation and recommendations for the New Carlisle Well site. The HAS concluded that vinyl chloride (VC) levels in drinking water supply wells posed a public health hazard to residents and workers drinking the water and recommended an alternative water supply for these residents and workers, continued monitoring of down-gradient drinking water wells, and to characterize the extent and source of contamination. The HAS, working as a cooperative agreement partner with ATSDR, documented these conclusions in a public health consultation (PHC) (ATSDR, 2006). A USEPA Time-Critical Removal Action hooked the nursery and two residences on the property up to the City of New Carlisle public water supply. The emergency action was initiated on September 12, 2005 and completed on October 20, 2005. A health consultation documenting the HAS evaluation of the New Carlisle Well site and the resulting USEPA removal action was completed and released on April 3, 2006 (ATSDR, 2006).

In April 2009, the New Carlisle Landfill site was added to the list of NPL sites as the result of concerns that groundwater contamination could migrate to area residential wells (USEPA, 2008). Residents down-gradient of the landfill rely on the groundwater for their drinking water supply. The groundwater contamination continues to pose a potential health threat to these residents as long as the source of contamination and the contaminated groundwater has not been isolated, contained, or removed.

BACKGROUND

Site Location

The New Carlisle Landfill site is located in a largely rural, mixed agricultural and low-density residential portion of Bethel Township in Clark County, 1.5 miles south-southwest of the city of New Carlisle, Ohio (Figure 1). New Carlisle is in southwest Ohio, approximately 14 miles northeast of Dayton and 11 miles west of Springfield. The New Carlisle Landfill is estimated to cover approximately 21.7 acres (Figure 2). The landfill is bounded to the east by State Route 235 and the New Carlisle Cemetery across the Route 235, to the south by several acres of undeveloped property which has been characterized as a marshy area with dense undergrowth. The remaining area around the landfill is planted by commercial nurseries, with Honey Creek farther to the north and Scarff Road farther to the west. The nurseries use this land for propagating trees and shrubs which are irrigated on a regular basis. There are two residences and a business located on the landfill property. The residences and business are located east of the land filled area along State Route 235. The business, located at the northeast corner of the site, is currently a used car lot (Ohio EPA, personal communication, October 27, 2011).

Site History

The New Carlisle Landfill operated for approximately 20 years, from the late 1950's until closing in 1977. A former landfill operator stated that they accepted industrial, commercial, and residential refuse, which was compacted to a depth of approximately 15 feet (USEPA, 2008). The landfill was operated under several names; the Delaney's Waste Collection Landfill, Landfill Systems, Inc. (a division of SCA Corporation), and the New Carlisle Landfill. During the early years of operation, leachate and runoff from the landfill reportedly discharged to a swamp bordering the facility to the southeast. A berm was reportedly constructed to collect and divert the leachate and runoff. Upon closure, the landfill was reportedly covered with two to four feet of soil and vegetative cover (USEPA, 2008).

REGIONAL HYDROGEOLOGY AND GROUNDWATER RESOURCES

The groundwater resource map for Clark County (J.J. Schmidt, 1982), groundwater studies by S.E. Norris et al. (1952), and maps of buried valley systems in Ohio by Cummins (1959), all indicate that the area under investigation is located above an extensive buried valley system consisting of a deep, pre-glacial bedrock valley backfilled with at least 165 feet of inter-bedded gravel, sand, and clay-rich glacial till (Figure 3). Water wells screened in the more permeable sand and gravel units in this buried valley aquifer system can locally produce over 1,000 gallons of water per minute (Ohio Department of Natural Resources, Division of Water, well logs). These very productive sand and gravel aquifers provide raw drinking water to the New Carlisle public water

system (well field roughly 1.5 miles northeast and up-gradient of the New Carlisle Landfill), process water to numerous local industrial and agricultural production wells, and drinking water to area residents via private residential wells throughout Bethel Township, south and west of New Carlisle.

These wells include all the production wells and residential wells on the nursery property and the surrounding area that were sampled by the Ohio EPA as part of their investigation of this groundwater contamination in 2002 and 2003 (Ohio EPA, 2006). Residential wells in the area typically obtain their water from the more productive sand and gravel units 60 to 100 feet below the ground surface. Groundwater studies carried out by Panterra (1993) as part of the City of New Carlisle's well-field protection plan indicate that groundwater flow in the area is to the southwest in the vicinity of the closed New Carlisle Landfill.

The buried valley aquifer beneath the New Carlisle Landfill is part of a system of buried valley aquifers that have been designated as a sole source aquifer (Great Miami/Little Miami/Mill Creek Basins). This federal designation was established to protect drinking water supplies in areas that have few or no alternative sources of drinking water.

DEMOGRAPHICS

In the 2000 census, there were a total of 5,735 people living in the city of New Carlisle with 96.2 percent white, 0.3 percent African-American, 0.3 percent Asian, 0.3 percent American Indian and 2.9 percent other, or two or more races. At that time of the 2000 Census, 27.1 percent of the people were 17 years old or younger, 58.1 percent were between the ages of 18 and 64, and 14.8 percent were 65 years old or older. There was a total of 2,286 housing units with 2,207 households and an average of 2.56 persons per household. At the time of the 2000 Census, 73.1 percent of the housing units were owner occupied, 26.9 percent were rented and 3.5 percent were vacant. Based on 1999 income, 11.5 percent of the people (of all ages) living in New Carlisle were living with incomes below the poverty level (Census, 2000).

LAND USE

Clark County, Ohio, has a high percentage of the land use devoted to agriculture; 57 percent of the land is crops, 7 percent is pasture, and 12 percent is forest. Approximately 21 percent of the land is urban (residential, commercial, industrial, transportation and urban grassland). The remaining land in the county is covered by open water and wetlands. The New Carlisle Landfill site is surrounded primarily by agricultural land consisting of several large commercial nurseries, a cemetery, and a limited number of residences. A used car lot is located on the site property, and previous businesses at this location may also have included auto repair services. There are also commercial properties located southeast of the site, located east of the nursery on the east side of State Route 235, and currently include a vacant YMCA building, a day care, and a social

services provider (Ohio EPA, personal communication, October 27, 2011). More urban residential and commercial portions of the city of New Carlisle are about one mile to the north and upgradient of the landfill.

Existing groundwater data does not indicate the presence of other facilities in the area that could be potential sources of the identified groundwater contamination (USEPA, 2008).

DISCOVERY - OHIO EPA

In 1993 the Ohio EPA Division of Drinking and Ground Water began periodic review of water quality sampling results from a non-community transient public water supply well operated by the nursery south of the landfill. The nursery is approximately 1,300 feet south of the landfill and the well supplied potable water to approximately 115 workers at the main office and two residences on the property (Ohio EPA, 2006). The primary use of the water was reportedly for washing, flushing toilets, etc. and not for consumption (most workers drank bottled water). On successive occasions, the well exceeded the MCL for vinyl chloride (in 2000, 2001, and 2002) with the levels of vinyl chloride increasing with time. The Ohio EPA, in August 2002, issued an enforcement action to discontinue the use of the well as a public water supply. The nursery restricted use of the water from the well to irrigation and in August of 2003, installed a new non-community transient public well to supply the nursery office with water and two new residential wells, one for each of the two residences that were originally supplied with water from the former nursery well. The new public well was located 750 feet to the south of the former public well and obtained water from a depth of 112 to 122 feet below ground surface (bgs) (the former public well was screened from 60 to 70 feet bgs).

New Well Contamination

The nursery's detection of vinyl chloride in the new nursery public production well in August 2004 prompted the Ohio EPA to sample the new public well, the on-site residential wells, and other down-gradient residential wells. The Ohio EPA sampled the nursery's new public well on March 11, 2005, and vinyl chloride was detected at levels of 2.23 parts per billion (ppb), slightly above the federal public drinking water standard for vinyl chloride (MCL = 2.0 ppb) (Table 1 and Figure 4) (Ohio EPA, personal communication, 2005).

Groundwater Investigations

The Ohio EPA completed a Site Inspection (SI) in September 2003 (Ohio EPA, 2006). During the SI investigation, a total of 21 wells were sampled: 8 residential wells, 5 irrigation wells, and 8 public supply wells (two of the public wells include the Former Public Well and the New Public Well). In addition, 24 direct push Geoprobe groundwater

samples were also collected. One of the residential wells, RW-14, had a detection of 1,2-Dichloroethane at 0.2 ppb (MCL = 5 ppb) and the former public well at the nursery had a detection of vinyl chloride at 16 ppb, although in May 2003 it was non-detect (USEPA, 2008). During the SI Investigation, two out of eight residential wells sampled were on the landfill property. Volatile organic compounds were not found in either of these two wells (Ohio EPA, personal communication, October 27, 2011).

The Ohio EPA completed an Expanded Site Inspection (ESI) in May 2006 (Ohio EPA, 2006). The scope of these investigations included soil, leachate, and groundwater sampling of the nursery property and the nearby suspected source area, the former New Carlisle Landfill. Groundwater samples were collected in the vicinity of the landfill, the nursery, and adjacent down-gradient residential and public drinking water wells within 3,000 feet of the nursery facility and the New Carlisle Landfill (Ohio EPA, 2006) (Figure 4). Two additional residential wells, the former public well, and four additional direct push Geoprobe groundwater sites were sampled. A concentration of 24.1 ppb of vinyl chloride was detected in the former public well in March 2005 (USEPA, 2008).

The Ohio EPA sampled the groundwater beneath in the former disposal area on March 2005 and detected elevated levels of trichloroethylene (TCE) (up to 1,010 ppb) at shallow depths (20 to 24 feet below ground surface (bgs)) with lower levels detected as depth under the landfill increased (139 ppb at 36 to 40 feet bgs and 53.1 ppb at 56 to 60 feet bgs) (Ohio EPA, 2006). Vinyl chloride (17.4 ppb) and cis-1,2-dichloroethene (DCE) were also detected in this same sample.

Other water supply wells in the area were sampled by the Ohio EPA as early as November, 2002 and December, 2003 and did not detect chlorinated solvent parent products (such as trichloroethylene, trichloroethane, or tetrachloroethylene) or their degradation products, including vinyl chloride (Ohio EPA, 2006). The wells sampled include the public water supply well that provides potable water to the seasonal migrant camp on the nursery property (Ohio EPA, 2006). This migrant camp well is up-gradient or lateral to the New Carlisle Landfill and is not in the area of groundwater contamination.

The March 11, 2005, sampling of the two residential wells on the nursery property by the Ohio EPA detected vinyl chloride at levels just below the drinking water MCL. Neither of these wells previously had detections of vinyl chloride. April 2005 sampling of these two wells by the USEPA produced similar results (Table 2).

Additional Groundwater Data

Elevated levels of vinyl chloride (up to 58 ppb) and chloroethane (up to 220 ppb) plus low levels of 1,2-dichloroethene (up to 15 ppb) were detected in the groundwater at depths of roughly 60 feet below ground surface (bgs) in samples of groundwater collected from the northern edge of the nursery property during the course of the ESI (Figure 4). These samples were collected within a 500 foot radius of the contaminated

former public well.

Previous sampling, in November 2002, indicated low levels of chlorinated VOCs; chloroethane (up to 630 ppb) and 1,1-dichloroethane (up to 98 ppb), plus traces of vinyl chloride (up to 0.8 ppb) in leachate and groundwater at generally shallow depths (12-16 feet bgs) along the southwestern perimeters of the landfill (Ohio EPA, 2006).

Indications that New Carlisle Landfill is the Source

The contaminants of concern in the on-site groundwater samples and the two production wells on the down-gradient nursery property consist primarily of vinyl chloride, a breakdown product of chlorinated ethenes like perchloroethylene (PCE) and TCE, and chloroethane, a breakdown product of 1,1,1-trichloroethane, both detected at depth roughly 60 feet bgs. The detections of elevated levels of TCE in shallow groundwater at the landfill site, the distributions of groundwater contaminants at depth within the aquifer, the degraded nature of the chemical contaminants in the groundwater plume coupled with a lack of parent products in the intervening shallow intervals of the aquifer on the nursery property, the southward direction of groundwater flow in the region (Pantera, 1993), plus an absence of evidence of other potential sources in the area, all indicate that the closed New Carlisle Landfill is the source of the groundwater contamination in the area under investigation.

USEPA Time-Critical Removal Action

The Ohio EPA asked the USEPA Emergency Response Branch for assistance at this site due to the continued threat to public and private water supply wells. As an initial action, the USEPA collected water samples from the new public well as well as two nearby residential wells proximal to the new public well. On April 18, 2005 the USEPA sampled the new well at the nursery and had similar results (vinyl chloride=2.11 ppb) (USEPA, pers. Comm., 2005) (Figure 4). In support of this possible removal action, the HAS was asked by the USEPA On-Scene Coordinator April 21, 2005, to complete a Public Health Consultation document reviewing and evaluating the public health threat by the contaminated water supply wells in the vicinity of the New Carlisle Landfill site.

A review of the history of the contaminant issues at the New Carlisle well site and a discussion of current drinking water contaminant issues and potential remedial responses occurred at an inter-agency meeting between the Ohio EPA, the USEPA, and the HAS on April 27, 2005. The agencies participated in a site visit at the New Carlisle well site later the same day and entered into discussions with the nursery owner and operator with regard to possible remediation options and the potential for a USEPA Time-Critical Removal Action. The HAS submitted a draft health consultation in support of the proposed removal action to the USEPA OSC (May 16, 2005).

Several options were considered for the New Carlisle well site, including installation of water treatment systems on each of the impacted wells; drilling of new water supply

wells on the property, and extending the public water supply from the City of New Carlisle to the site. All of the agencies agreed that extending the public water lines to the New Carlisle well site from the existing city mains north of the site along State Route 235 was the most effective long-term option from a public health perspective.

The USEPA OSC submitted an Action Memo requesting the funding for the project which was approved by the USEPA on May 26, 2005. Public water supply lines were extended along State Route 235 to the nursery property between September 12, 2005 and October 14, 2005. Existing groundwater well connections were capped. Water lines were completed to the main building at the nursery and to the two on-site residences. On October 20, 2005 the USEPA's contractors collected water samples from the formerly-impacted locations to confirm that city water was being delivered to the faucets. Drinking water samples collected from the main office and the two residences had no detectable levels of vinyl chloride or any of the other chemicals of concern (USEPA, 2005).

DISCUSSION

Exposure Pathways Analysis

For area residents and workers *to be exposed* to elevated levels of chemical contaminants in and around the New Carlisle Landfill site they must first come into contact with the contaminated groundwater, surface water, soils, sediment, or air. To come into contact with the contaminated media there must be a *completed exposure pathway*. A completed exposure pathway consists of *five main parts*, which must be present for a chemical exposure to occur. These include:

- A Source of the Toxic Chemicals of concern;
- A method of Environmental Transport, which allows the chemical contaminant to move from its source (soil, air, groundwater, surface water, sediment);
- A Point of Exposure where the residents come into direct physical contact with the chemical (on-site, off-site);
- A Route of Exposure, which is how the residents come into physical contact with the chemical (drinking, eating, touching); and
- A Population at Risk which are the people who could possibly come into physical contact with site-related chemicals.

Exposure pathways can also be characterized as to when the exposure occurred or might occur in the *Past, Present, or Future*.

Physical contact with a chemical contaminant, in and by itself, does not necessarily result in adverse health effects. A chemical's ability to affect a resident's health is also controlled by a number of factors, including:

- How much of the chemical a person is exposed to (the dose).
- How long a person is exposed to the chemical (duration of exposure).

- How often a person is exposed to the chemical (frequency).
- The toxicity of chemicals the person is exposed to (how chemicals can make people sick).

Other factors affecting a chemical's likelihood of causing adverse health effects upon contact include the resident's:

- Personal habits
- Diet
- Age and sex
- Current health status
- Past and current exposures to toxic chemicals (e.g., workplace, hobbies, etc.)

The primary contaminants of concern in this groundwater plume are vinyl chloride and chloroethane. These chlorinated compounds are biodegradation products of PCE and/or TCE and trichloroethane (TCA) in the groundwater under low or depleted oxygen conditions at depth in soils.

Completed Exposure Pathway

Groundwater Pathway

The New Carlisle Landfill site is documented as the source of a localized groundwater contamination plume that is migrating along a southerly path that roughly parallels State Route 235 (also known as North Dayton-Lakeview Road) (ATSDR, 2006) (Figure 4). Residents and workers were supplied with water from wells located on the nursery's property just south of the landfill. The nursery's public wells intercepted the groundwater plume and the dissolved phase contaminants (Figure 4). Vinyl chloride concentrations in the well water exceeded the MCL on several occasions. In 2005, a public water supply line was extended south on State Route 235 to the nursery and residents and workers are no longer exposed to contaminated drinking water.

Potential Exposure Pathways

Groundwater Pathway

A number of additional residences in the immediate vicinity of the nursery property still use private wells and the aquifer as their source of drinking water and remain at risk of exposure via their drinking water supply. The nearest residential wells, down-gradient of the contaminated public wells and the plume, were sampled semi-annually from 2005 through 2007 and had no detections of contaminants of concern (Ohio EPA, 2011). These groundwater data suggest that there are no current exposures. However, the groundwater contaminants could migrate to nearby residential wells in the future. The vinyl chloride levels went from non-detect to above the MCLs within a short time span, within a year or so at the nursery. However, sampling recently conducted on October 24, 2011, by the Clark County Combined Health District of the four down gradient private

wells indicated no detectable levels of vinyl chloride (reporting limit = 2 ppb) or other VOCs (Figure 5).

Vapor Intrusion Pathway

The groundwater plume, based on the previous groundwater sampling done in 2003, 2005, and 2007 by the Ohio EPA, is a narrow, linear, sinking plume, extending north to south from the New Carlisle Landfill property south-southwest to the Scarff's Nursery property (Figure 5). There were minimal or no detects of site-related VOCs to the west, south, or east of the new public water supply well on the south end of the Scarff's Nursery property. The depth to the groundwater contamination (VC @ 88 ppb) in monitoring well GW43 at the north edge of the nursery property and 1,000 feet south of the Landfill property is 60-64 feet below the ground surface. Further south onto the Scarff's Nursery property, the VC levels in the groundwater drop off to 24 ppb at the former public well (60-70 feet deep) and 2.23 ppb in the new public water supply well at the south end of the Scarff's Nursery property (112-122 feet deep) (see Figure 4). Hypothetically, there is a potential for a completed vapor intrusion pathway as the maximum VC concentration of 28.3 µg/l was detected in the former public well in December 2005. This value exceeds the Vapor Intrusion Guidance screening level of 25 µg/l for VC in groundwater (USEPA, 2002).

However, it is highly unlikely that the contaminated groundwater plume poses a vapor intrusion threat in the off-site areas south of the northern edge of the nursery property (1,000 feet south of the New Carlisle Landfill property line). South of the landfill site, contaminants have been found deep (112 to 122 feet bgs) in the aquifer and not in the shallow groundwater immediately beneath residential or commercial buildings. In general, if occupied buildings are not laterally or vertically within 100 feet of volatile subsurface contaminants, then exposure via the vapor intrusion pathway is unlikely. In addition, the Expanded Site Inspection indicates that there is a clay layer (at approximately 40 to 50 feet bgs) between the groundwater plume contaminants and the surface that likely will prevent vertical migration of vinyl chloride or chloroethane vapors from the groundwater into overlying structures. However, this clay layer needs to be characterized further to determine if it provides a sufficient barrier to the vertical migration of contaminated vapors into overlying structures.

The vapor intrusion pathway could pose an exposure hazard to workers on the landfill property itself, as chlorinated VOCs (TCE at 1,010 ppb) have been detected in monitoring wells at much shallower depths on the landfill property (20-24 feet bgs at GW32). There could be potential exposure from vapor intrusion to the on-property residents and business. In addition, there could be potential explosive risks from landfill gases, such as methane, at the on-site residences and business. There is a less significant vapor threat in the adjacent undeveloped wetlands area between the landfill and the Scarff's Nursery property to the south.

Chemicals of Concern

Vinyl chloride and chloroethane are the site-related chemicals of concern associated with the groundwater contamination at the nursery. These contaminants are the biological breakdown products of chlorinated industrial solvents, likely TCE and trichloroethane (TCA) disposed of in the New Carlisle Landfill. Additional site-related compounds detected in area groundwater include other biodegradation products, including 1,1-dichloroethane (DCA) and 1,2-dichloroethene (DCE). All of these chemicals are volatile organic compounds (VOCs). These are organic compounds that, upon exposure to the air, readily vaporize from a liquid to a gas.

These chemicals of concern associated with the New Carlisle Landfill site tend to be mobile in soil and soluble in groundwater. The chlorinated solvents TCE and TCA tend to be denser than water and sink in the aquifer with time and distance from the source area. As these chemicals sink through the aquifer, the increasing distance from oxygen at the groundwater surface enable bacteria to break down the 1,1,1-TCA and TCE. TCE breaks down to 1,2-DCE and then vinyl chloride. TCA breaks down to 1,1-DCA and then chloroethane or it will break down to 1,1-DCE and then vinyl chloride (Vogel, Criddle, and McCarty, 1987).

Vinyl Chloride

Vinyl chloride is a man-made chemical, typically a sweet-smelling colorless gas, used in the manufacture of polyvinyl chloride (PVC) products. As indicated above, it also forms as the result of the biological degradation of chlorinated solvents like PCE and TCE in groundwater under anaerobic (oxygen-poor) conditions that increase with depth below the ground water surface (Smith and Dragun, 1984; Vogel and McCarty, 1985).

Vinyl chloride is classified as a Class A carcinogen, a “known human cancer-causing agent” by the USEPA and the US Department of Health and Human Services (DHHS, 2002) based on evidence from both human occupational health studies and animal laboratory studies (Agency for Toxic Substances and Disease Registry, 2004). Occupational studies of workers in the vinyl chloride industry in the 1970’s (Creech and Johnson, 1974; Heath et al., 1975; Fox and Collier, 1977) demonstrated a link between chronic occupational exposure to high levels of vinyl chloride in the air in an enclosed environment (estimated vinyl chloride concentrations of several thousand parts per million) and the development of hepatic angiosarcoma, a rare and fatal form of liver cancer. Besides liver cancer, workers exposed to very high levels of vinyl chloride in the air on a regular basis also developed “vinyl chloride disease”. Symptoms included liver abnormalities; the development of “acroosteolysis”, a degenerative loss of bone from the tips of the fingers, in addition to the formation of skin lesions and nodules on the hands and forearms. Additional studies of workers in the vinyl chloride industry indicated less conclusively an association between exposures to high levels of vinyl chloride vapor and/or PVC dust and the development of cancers of the brain, lungs, and digestive tract (Wagoner et al., 1980; Wong et al., 1991).

In contrast to occupational studies of human exposures to vinyl chloride via the inhalation route, no similar human epidemiological studies have demonstrated associations between drinking vinyl chloride-contaminated water and the development of cancers. Similarly, no studies could be found linking oral exposure to vinyl chloride in humans with the development of neurological, developmental, reproductive, genotoxic, or dermal health effects (ATSDR, 2004). However, studies of laboratory rats fed large doses of vinyl chloride as PVC powder or via gavage (feeding by stomach tube) led to statistically-significant increases in the incidence of liver tumors in these animals (Feron et al., 1981; Maltoni et al., 1981; Til et al., 1983). Based on the evidence of carcinogenicity in animals after oral exposure, both the DHHS (2002) and the USEPA (1994) have considered it to be prudent public health practice to consider the potential for carcinogenic effects in humans by this route as well as via inhalation. The USEPA's current weight-of-evidence characterization for vinyl chloride concludes that vinyl chloride is a known human carcinogen by the inhalation route of exposure based on human epidemiological studies and, by analogy, considered to be carcinogenic by the oral route based on positive animal laboratory studies.

On this basis, the USEPA established a public drinking water Maximum Contaminant Level Goal of zero for vinyl chloride in drinking water supplies. The actual Maximum Contaminant Level (MCL) for vinyl chloride has been established to be 2.0 parts vinyl chloride per billion parts of water (MCL = 2.0 ppb). This concentration has also been adopted by the USEPA as the numeric Removal Action Level (RAL) for vinyl chloride at federal Superfund sites with contaminated drinking water (1997).

The Agency for Toxic Substances and Disease Registry (ATSDR) has developed Cancer Risk Evaluation Guide (CREG) numbers for specific carcinogens that calculate at what levels exposure to the chemical could result in additional cancer cases per million people (1×10^{-6} risk). The CREG value for vinyl chloride is 0.02 ppb in drinking water. The estimated theoretical cancer risk for people exposed to vinyl chloride by drinking well water from the New Carlisle Landfill site was based on this value (ATSDR's CREG of 0.02 ppb). This calculated theoretical cancer risk is based on a hypothetical exposure scenario that assumes each adult person weighs 70 kg and drinks two liters of water during a lifetime of exposure. Using these assumptions, the theoretical cancer risk due to drinking water with the highest level of vinyl chloride (16 ppb) was calculated to be about 7 additional cancer cases in a population of 10,000. However, the true risk is likely to be far less than the calculated theoretical cancer risk which is based on people drinking 2 liters of water from the same water source for a lifetime (see Appendix A).

Vinyl chloride detected in the water supply wells at the nursery has its source in the groundwater under the New Carlisle Landfill, approximately 1,300 feet up-gradient and to the north of the nursery (Ohio EPA, 2006). Vinyl chloride has been detected at trace levels at shallow depths at the landfill (1-2 ppb) with increasing concentrations detected in deeper depths (50-70 feet bgs) in down-gradient monitoring wells and groundwater samples collected along the north end of nursery property (16-58 ppb). The Ohio EPA sampled the nursery's new public well on March 11, 2005, and vinyl chloride was

detected at levels of 2.23 ppb, exceeding the federal public drinking water standard for vinyl chloride (MCL = 2.0 ppb) (Table 1 and Figure 4) (Ohio EPA, pers. comm., 2005). Trichloroethylene (TCE) was found in the groundwater beneath the site at a concentration as high as 1,010 ppb, but was not found in off-site samples. TCE breaks down in groundwater under anaerobic conditions to 1,2-dichloroethylene and which then breaks down to vinyl chloride and chloroethane. The TCE is thought to be the source of vinyl chloride and chloroethane contamination.

Chloroethane

Like vinyl chloride, chloroethane (CA) is a man-made, colorless gas at room temperature. It has a sharp odor that can be detected at levels above 4,000 parts per billion by volume (ppb) in air and above 20 ppb in water. Under pressure, it can be a liquid that will readily vaporize upon exposure to the atmosphere. In the past, it was used in the production of tetraethyl lead additives in gasoline and as a surgical anesthetic (ATSDR, 1998). Currently, it is used as a solvent and refrigerant as well as an intermediary in the production of dyes, drugs, and as a component of commercial household products, including paints, solvents, air fresheners, and deodorant sprays. It is also used as “numbing agent” in minor surgery. As indicated above, CA also occurs in groundwater as one of the end-products of the anaerobic biodegradation of more complex chlorinated ethanes like the common solvent 1,1,1-trichloroethane (Vogel, Criddle, and McCarty, 1987).

Elevated levels of CA (up to 630 ppb) were detected in a number of shallow groundwater samples (12-16 feet depth) collected from the immediate vicinity of the New Carlisle Landfill and from Geoprobe groundwater samples (GW-12D) collected from depths of 54-58 feet bgs at the northern edge of the nursery property (up to 220 ppb) (Ohio EPA, 2006). Chloroethane was detected only at trace levels (0.9 ppb) in the former water supply well on the nursery property. In contrast to vinyl chloride, chloroethane is not very toxic, either acutely or chronically, to humans or lab animals. There are a limited number of epidemiological studies investigating the health effects from exposure to the compound. Adverse health effects (loss of consciousness, loss of muscular control, seizures) have been identified in people who intentionally abused (inhaled) high levels of CA or were exposed to it as an anesthetic during surgery (likely in the 1,000’s of parts per million range in air). Similar central nervous system effects were observed in workers accidentally exposed to elevated levels of chloroethane in the workplace (ATSDR, 1998). Chloroethane is currently classified by the International Agency for Research on Cancer (IARC) as a Group 3 carcinogen – there is no data available indicating that exposure to CA causes cancer in humans or animals.

The Occupational Safety and Health Administration (OSHA) has established an occupational exposure standard of no more than 1,000 parts per million CA in air in the work environment over an 8 hour period for a 40-hour work week. There are no Maximum Contaminant levels or other drinking water standards for CA in drinking water supplies. At the levels detected in the public well water, chloroethane is not expected to

cause any health effects and is not known to cause cancer.

HEALTH OUTCOME DATA

In addition to evaluating exposure and substance-specific toxicological information, the Ohio Department of Health and ATSDR may review any health outcome data, such as the number of reportable diseases or deaths in a community, as part of the public health assessment process. ATSDR evaluates health outcome data if there is: (1) a current (or past) completed or potential exposure pathway, (2) a way to know the levels and length of exposure, (3) an identified exposed population that is of sufficient size for the health effects to be detected (4) sufficient exposure to result in plausible health effects, (5) information available at the geographic level necessary to compare to the exposed population, and (6) a database on the health outcomes of interest likely to occur from exposure.

There was a past completed exposure pathway and currently there is a potential exposure pathway. Data from samples collected between November 2002 and March 2005 indicate that there were three samples which exceeded the MCL for vinyl chloride from the former and new public wells and six samples that were below the MCL. Workers at the nursery reported that once contaminants were found in the wells they began drinking bottled water. There were no detections of contaminants in on-site residential wells until 2005. The new water supply was provided to the nursery and residents in 2006. The duration of the exposure was not sufficiently long to reasonably expect health effects when the estimated theoretical effects are based on 30 year exposure. The potentially impacted population is the workers and residents of the nursery using the public water supply wells as a potable water source. Due to the small number of people exposed, the analysis of health outcome data is impractical to measure for this rate of disease. For example the calculated rate is 1 in 10,000 and less than 150 people were exposed. Although there may be some workers in the office and the two residences on the nursery that could be identified as likely exposed, it is difficult to identify the exposed population at the nursery in that it is seasonal work with some migrant workers. Due to migrant workers and office workers not being confined to a geographical area, there is no way to include or exclude the exposed population from the non-exposed population. The duration of the exposure was not sufficiently long to reasonably expect health effects when the estimated theoretical effects are based on 30 year exposure.

The Ohio Cancer Incidence Surveillance System (OCISS) reported that the cancer incidence rate for Clark County for all sites/types was lower than the incidence rate for the United States. The disease potentially linked to vinyl chloride exposures is liver cancer, which is available in this profile only at the county level, and therefore may not be useful for comparison to a smaller geographical area. The reported cases for liver cancer are few in number and the incidence and mortality rates for Clark County are less than those reported for all of Ohio and the United States (OCISS, 2008).

The health outcome data are not available at a geographic level specific enough to allow

for correlation with the exposed population at the New Carlisle Landfill site. In addition, the exposed population is too small to enable a statistical comparison.

COMMUNITY HEALTH CONCERNS

The public water wells at the nursery supplied water to the office and two residences on nursery property prior to 2006. The former public well and the new public well were regularly monitored for contaminants when in use. Workers at the nursery stated that they drank bottled water when they learned that contaminants were detected in the well water. The nursery office workers only used the well water for washing hands and flushing toilets. These workers did not have any concerns about possible health effects from exposure. The owner of the nursery stated that some of their family members lived in the two residences that were supplied water from the public water wells and these family members were not concerned about health effects related to their exposure to the contaminants. Currently, the community does not have any new health concerns. Due to the frequent monitoring of these wells, any exposure that may have occurred was likely to have been very brief. If an exposure did occur, it was likely to have been to very low concentrations that would not be expected to cause any health effects over such a limited amount of time.

Child Health Considerations

Both the ATSDR and the HAS recognize the unique vulnerabilities of children exposed to environmental contamination and hazards. As part of this health consultation, the HAS considered the greater sensitivity of the children who live in the area of the New Carlisle Landfill site when drawing conclusions and making recommendations regarding health effects from exposure to chemicals related to the New Carlisle Landfill site.

CONCLUSIONS

- In the past, drinking groundwater contaminated with volatile organic compounds (VOCs) from public and residential wells down-gradient of the New Carlisle Landfill for a year or longer could harm people's health. This was a public health hazard in the past. However, a safe alternative public water supply was provided by the USEPA in 2006, eliminating the exposure. Groundwater data in the recent past indicated two public and two private water supply wells were contaminated with vinyl chloride, a known human carcinogen, at levels above the federal drinking water standard. Possible health problems for people drinking water contaminated with vinyl chloride for a year or longer are potential carcinogenic effects. Non-cancer effects are not expected at the low concentrations detected.
- Currently, drinking groundwater from public or residential wells down-gradient of the New Carlisle Landfill is not expected to harm people's health. In the future, however, groundwater contamination might impact public or residential wells down-gradient of

the New Carlisle Landfill and harm people's health. Groundwater monitoring data from 2007 indicates that the contaminants have not migrated beyond the nursery. Testing recently conducted on October 24, 2011 by the Clark County Combined Health District of the four down gradient private wells indicated no VOCs. It is uncertain whether or not the plume is continuing to migrate and that down gradient wells are at risk of future contamination.

- The HAS cannot currently conclude whether vapor intrusion of VOCs into nearby residences or businesses could harm people's health. The information needed to make a decision is currently not available. We are working with the USEPA to gather the needed information.

RECOMMENDATIONS

- As part of the Remedial Investigation to be conducted at this site, the HAS recommends that the full extent and nature of the groundwater contamination in the area be determined.
- Additional sampling of the groundwater in this area including public and private water supply wells is strongly recommended to ensure that contaminants are not posing a health threat to area residents or workers through the drinking water route.
- The source of contamination and the contaminated groundwater need to be fully identified, isolated and contained, or removed so that workers or residents in the area are not exposed to contaminated drinking water in the future.
- Soil gas samples near residences and occupied commercial buildings need to be collected to assess the potential for vapor intrusion route of exposure. The clay layer needs to be characterized further to determine if it provides sufficient barrier for the vertical migration of contaminated vapors into overlying structures.

PUBLIC HEALTH ACTION PLAN

Completed Actions

- The HAS and the ATSDR provided a draft public health consultation to the USEPA On Scene Coordinator in 2005 for the New Carlisle Well Site, in support of the USEPA Time Critical Removal Action to eliminate the ongoing exposure of area workers and residents to VC in drinking water.
- A USEPA Emergency Removal Action, hooking the nursery and on-site residents to the public water supply, was completed in October 2005. New Carlisle residents and workers at the nursery are no longer being exposed to vinyl chloride via the drinking water supply.
- The Ohio EPA completed an Expanded Site Inspection at the New Carlisle Landfill

site at the request of the USEPA in 2006.

- On the basis of these data, the New Carlisle Landfill site was proposed for the NPL in September 2008 and placed on the NPL of Superfund sites in April 2009.

Ongoing Actions

- Additional investigations at this site are currently being pursued under the USEPA's Superfund authority to identify and remediate contamination associated with the New Carlisle Landfill site, the source of groundwater contamination, and evaluate threats to public health in the area of the site.
- The RI/FS Remedial Investigation/Feasibility Study being conducted by the USEPA Superfund program began September, 2010.
- The HAS is providing fact sheets for Vinyl Chloride, Exposure to Toxic Chemicals, and Cancer in Appendix B of this document and on ODH web page http://www.odh.ohio.gov/odhPrograms/eh/hlth_as/chemfs1.aspx.

Planned Actions

- The USEPA will complete the Remedial Investigation and remediate the site based on the results of this investigation.
- The HAS will evaluate additional data as it becomes available to determine if there are any potential health threats. The HAS will continue to address community health concerns related to exposure or potential exposure to site related contaminants.

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TABLES

Table 1. – Non-Community Public Water Well Sample Results		
Vinyl Chloride (ppb) MCL = 2 ppb		
Date Sampled	Former Public Well	New Public Well
November 2002	16	
May 2003	ND	
December 2003	ND	
February 2004	16	
August 29, 2003	Start using New Public Well	
August 2004		1.9
November 2004		1.8
December 2004		ND
January 2005		0.808
March 2005	24.1	2.23
October 2005	Water line installed	
December 2005	28.3	
Screened Depth	60-70 feet bgs	112-122 feet bgs

bgs – below ground surface

MCL – Maximum Contaminant Level USEPA drinking water standard

ND – Not Detected

ppb – parts per billion

Red bolded = levels above MCL

Table 2. - Groundwater Monitoring Well Sample Results					
Location	Date	Vinyl Chloride MCL = 2 ppb	Chloroethane No MCL	Cis-1,2- Dichloroethene MCL = 70 ppb	Trichloroethylene MCL = 5 ppb
Contaminated Monitoring Wells					
GW-4 S	11/2002		490	1	
GW-5	11/2002		39		
GW-12 D	11/2002	58	220	15	
GW-32 D	3/2005			10.8	53.1
GW-41 I	3/2005	15.1	1.34		
GW-41 D	3/2005	5.62	1.82		
GW-44D	3/2005	1.85			
Background Wells					
GW-1	11/2002	ND	ND	ND	ND
GW-2	11/2002	ND	ND	ND	ND
GW-3	11/2002	ND	ND	ND	ND
GW-14	11/2002	ND	ND	ND	ND
GW-26	3/2005	ND	ND	ND	ND
GW-27	3/2005	ND	ND	ND	ND
GW-17	11/2002	ND	ND	ND	ND

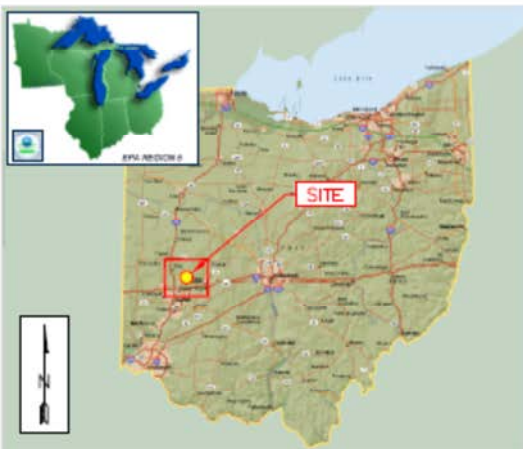
MCL – Maximum Contaminant Level USEPA drinking water standard

ND - Not Detected

ppb – parts per billion

Red bolded = levels above MCL

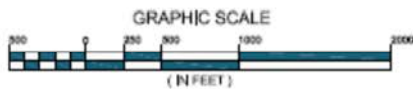
FIGURES



REGIONAL MAPS
SCALE: N.T.S.



VICINITY MAP/AERIAL



DRAWING NO.

FIGURE 1

DRAWN BY: D. GRANT

CHECKED BY: W. EARLE

DATE: AUGUST 2008



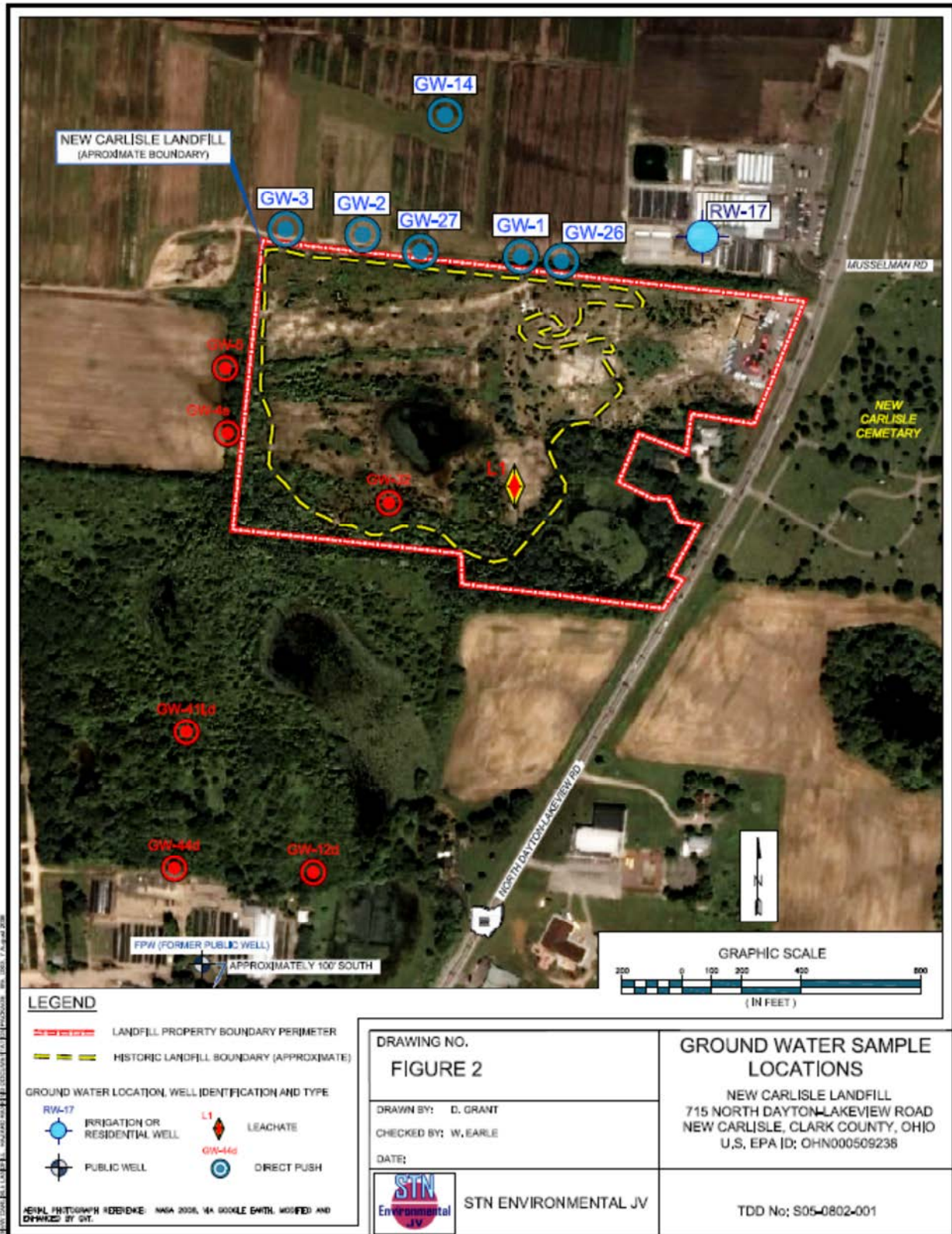
STN ENVIRONMENTAL JV

SITE LOCATION MAP

NEW CARLISLE LANDFILL
715 NORTH DAYTON-LAKEVIEW ROAD
NEW CARLISLE, CLARK COUNTY, OHIO
U.S. EPA ID: OHN000509238

TDD No: S05-0802-001

SOURCES: REFERENCE 13, FIGURE 1
BASEMAPS—EPA REGION 5; AFTER MICROSOFT MAPPOINT
NORTH AMERICA 2006, GEOCOMM.COM, GOOGLE EARTH, AND
USGS (NEW CARLISLE QUAD).



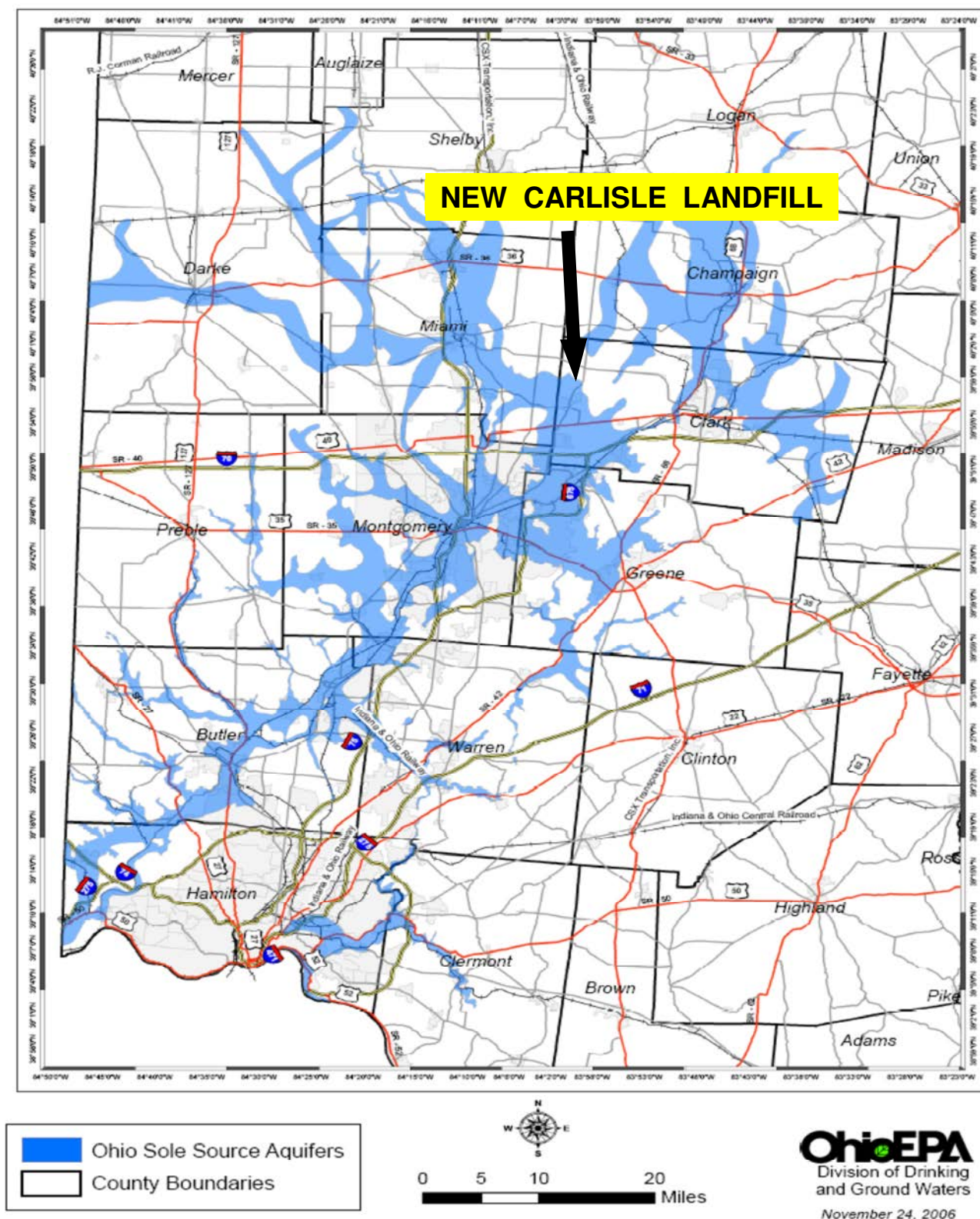


Figure 3 - The Greater Miami Sole Source Aquifer and New Carlisle Landfill Location

DRAFT

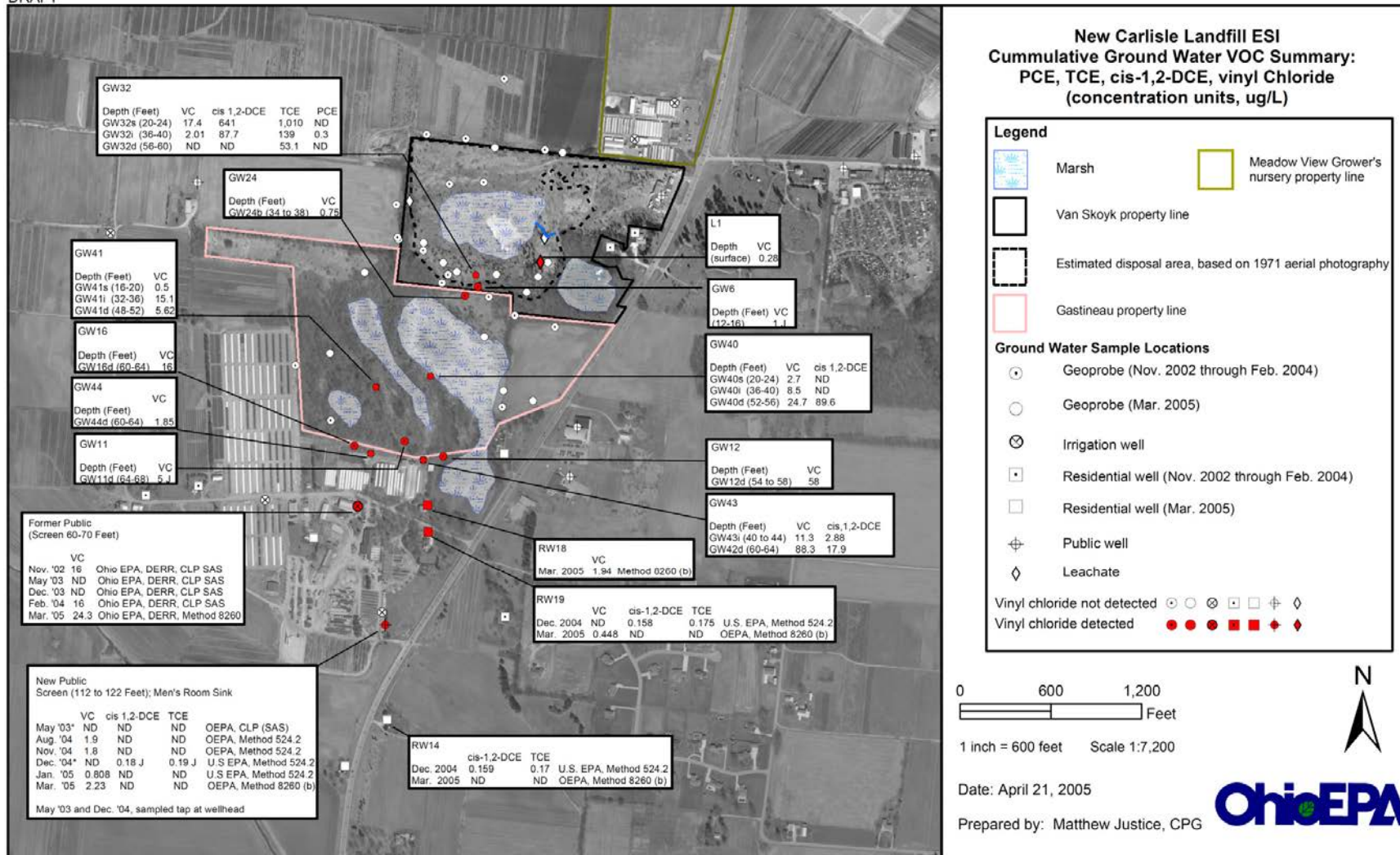


Figure 4 – New Carlisle Landfill Site Cumulative Groundwater VOC Summary

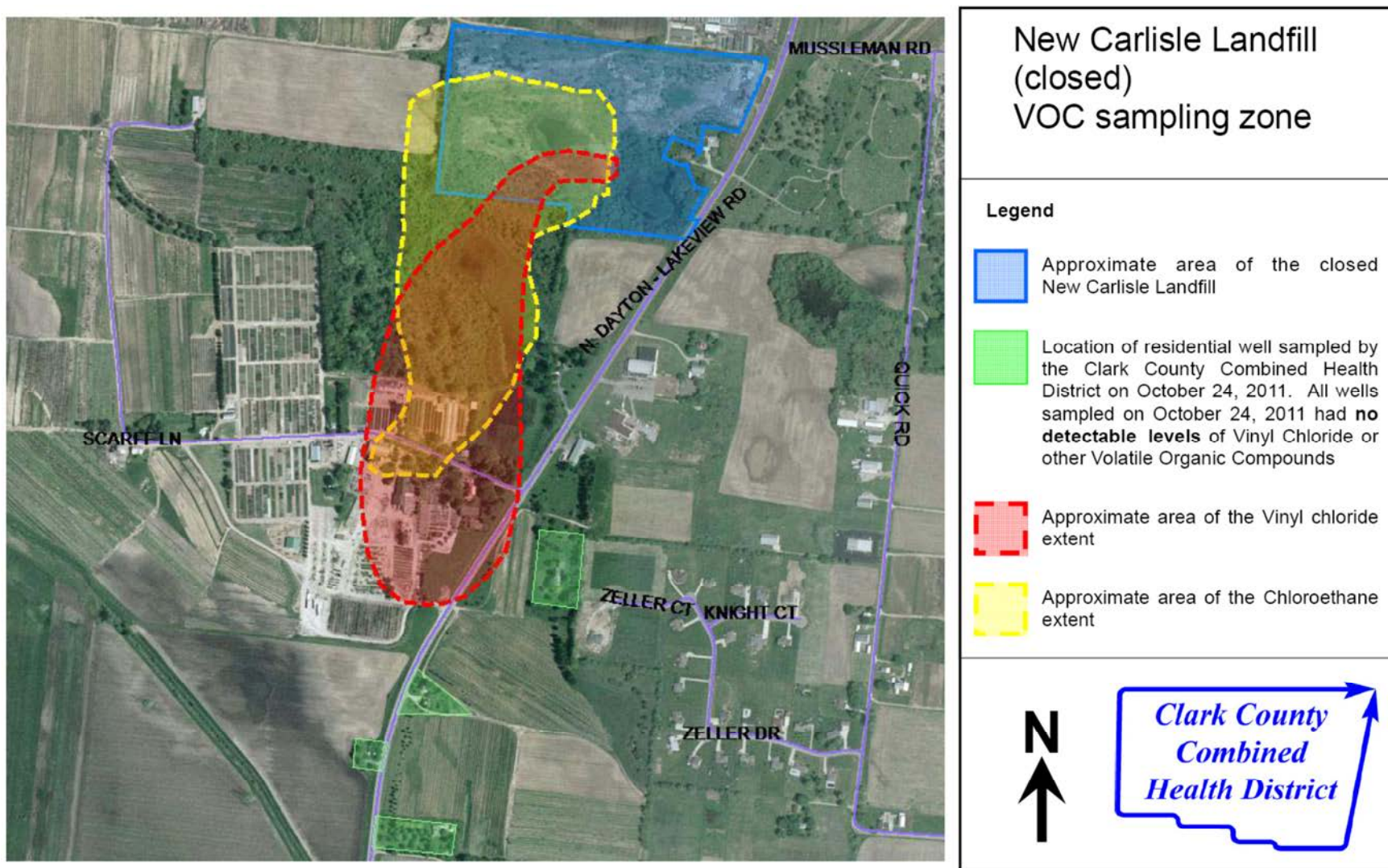


Figure 5 –Areas of VOC Extent and Location of Down Gradient Residential Wells

APPENDICES

Appendix A. Estimated Human Exposure Doses and Theoretical Cancer Risk

Exposure to a cancer-causing compound, even at low concentrations, is assumed to be associated with some increased health risk. The estimated theoretical cancer risk from exposure to contaminants associated with this site was calculated by multiplying the estimated exposure dose for each age group with the Cancer Slope Factor (CSF) for vinyl chloride. This calculation estimates the theoretical excess cancer risk expressed as a portion of the population that may be affected by a carcinogen during a lifetime of exposure. An estimated risk of 1×10^{-6} predicts the probability of one additional cancer, over background, in a population of 1 million. An increase in the lifetime cancer risk is not an estimate of expected additional cancer cases. Rather, it is an estimate of the increase in the probability that a person may develop cancer sometime in his or her lifetime following exposure to a particular contaminant.

Because of conservative safety factors used to calculate the CSFs, using these values provides only a theoretical estimate of risk; the true or actual risk is unknown and could be as low as zero. Risk estimates are generated using mathematical models applied to epidemiologic or experimental data for carcinogenic effects. These models extrapolate from higher experimental doses to lower experimental doses. Often, even the lower experimental doses represent exposures to chemicals that are at concentrations orders of magnitude higher than the concentrations found in the environment. These models also assume that there are no thresholds to carcinogenic effects; a single molecule of a carcinogen is assumed to be capable of causing cancer. The doses associated with these estimated hypothetical risks may be orders of magnitude lower than doses reported in toxicology literature to cause carcinogenic effects. A low cancer risk estimate (less than 10^{-6}) may indicate that the toxicology literature support a finding that no excess cancer risk is likely. A cancer risk estimate (greater than 10^{-6}), however, indicates that a careful review of toxicology literature before making conclusions about cancer risks is in order.

GROUNDWATER INGESTION CALCULATED EXPOSURE DOSES AND ESTIMATED THEORETICAL CANCER RISK

1. Assumptions, Limitations, and Default Values Used in Calculations Default Drinking Water Intake Rates;

2 Liters /day = Adult

1 Liter /day = Child

The default values are exposure assumptions that ATSDR uses when calculating drinking water comparison values. According to EPA's Exposure Factors Handbook (EPA 1997), the average adult and child (1-10 years) water intake rates are 1.4 L/day and 0.74 L/day, respectively. The 90th percentile drinking water intake rates for an adult and child are 2.3 L/day and 1.3 L/day, respectively.

2. Calculated Exposure Doses and Estimated Theoretical Cancer Risks

Appendix A Table 2 -Groundwater Ingestion Estimated Exposure Dose and Cancer Risk						
	Intake Rate (L/day)	Exposure Factor	Body Weight (kg)	Exposure Dose (mg/kg/day)	Cancer Slope Factor (mg/kg/day)	Cancer Risk
Child (1-17)	1	1.0	30	0.00053	1.5	8.0×10^{-4}
Adult (18-70)	2	1.0	70	0.00046	1.5	6.9×10^{-4}

3. Equation for Estimated Exposure Dose from Groundwater Ingestion*:

$$dose = \frac{concentration \times intake\ rate \times exposure\ factor}{body\ weight}$$

dose = estimated exposure dose (mg/kg/day)

concentration = contaminant concentration (mg/L)

vinyl chloride = 16 µg/L or 0.016 mg/L (maximum concentration)

intake rate = intake rate of contaminated water (L/day) default from ATSDR, 2005

exposure factor = exposure factor (unitless) default from ATSDR, 2005

body weight = body weight (kg) default from ATSDR, 2005

Example:

$$dose = \frac{\frac{0.016\ mg}{L} \times 1\ L/day \times 1.0}{30\ kg} = 0.00053\ mg/kg/day$$

$$dose = \frac{\frac{0.016\ mg}{L} \times 2\ L/day \times 1.0}{70\ kg} = 0.00046\ mg/kg/day$$

4. Equation for Cancer Risk*;

$$\text{Cancer Risk} = \text{Exposure Dose} \times \text{Cancer Slope Factor}$$

Cancer Risk = estimated theoretical cancer risk (unitless)

Exposure Dose = estimated exposure dose (mg/kg/day)

Cancer Slope Factor = cancer slope factor ([mg/kg/day]⁻¹)

Oral cancer slope factor for vinyl chloride = 1.5 per mg/kg/day

From USEPA, 2004 – Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). Final 2004. EPA/540/R/99/005.

Example:

$$\text{Child Cancer Risk} = 0.00053 \text{ mg/kg/day} \times 1.5 \text{ per mg/kg/day} = 8.0 \times 10^{-4}$$

$$\text{Adult Cancer Risk} = 0.00046 \text{ mg/kg/day} \times 1.5 \text{ per mg/kg/day} = 6.9 \times 10^{-4}$$

*Equations from ATSDR Public Health Assessment Guidance Manual 2005

Oral MRL Equation

The oral MRL is an estimate of the daily human exposure to a substance (in milligrams per kilogram per day) for oral exposures that is likely to be without noncarcinogenic health effects during a specified duration of exposure based on ATSDR evaluations.

$$\text{MRL} = \text{NOAEL} / \text{UF}$$

Where:

MRL = minimal risk level (mg/kg/day)

NOAEL = no-observed-adverse-effect-level (mg/kg/day)

UF = uncertainty factor (unitless)

Example:

$$\text{MRL} = 0.09 \text{ mg/kg/day} / 30$$

$$0.003 \text{ mg/kg/day} = 0.09 \text{ mg/kg/day} / 30$$

The chronic-duration oral MRL of 0.003 mg/kg/day was derived by dividing the PBPK-modeled equivalent human NOAEL of 0.09 mg/kg/day for liver cell polymorphisms by an uncertainty factor of 30 (3 for species extrapolation with a dosimetric adjustment and 10 for human variability).

Appendix B. Fact Sheets



**Bureau of
Environmental Health
Health Assessment Section**

"To protect and improve the health of all Ohioans"

Vinyl Chloride

Answers to Frequently Asked Health Questions

What is vinyl chloride?

Vinyl chloride is a colorless, flammable gas with a mild, sweet odor. It does not occur naturally in the environment but is a man-made product that is used to make polyvinyl chloride (PVC).

Polyvinyl chloride (PVC) is used to make a variety of plastic products including pipes, wire and cable coatings, and packaging materials. Before the mid-1970s, vinyl chloride was used as a coolant, used as a propellant in aerosol spray cans and could be found in some cosmetics.



Vinyl chloride can also be produced as a by-product or when chlorinated solvents such as TCE & PCE chemically break down.

How does vinyl chloride get in your body?

- By breathing (inhalation) vinyl chloride that has leaked from plastics industries, hazardous waste sites, and landfills.
- By breathing (inhalation) vinyl chloride in contaminated workplace air or having skin or eye contact.
- By breathing (inhalation) tobacco smoke from cigarettes or cigars.
- By drinking (ingesting) water from contaminated wells.

Most people begin to smell vinyl chloride in the air at 3,000 parts vinyl chloride parts per million (ppm) of air. However, this is too high a level to prevent adequate warning of exposure. Most people begin to taste vinyl chloride in water at 3.4 parts per million (ppm).

Before government regulations, vinyl chloride could get into food that was stored in materials containing PVC.

How does vinyl chloride affect your health?

It is hard to know what levels of exposure to vinyl chloride can cause health problems. The kinds of health problems and extent of problems that are seen with exposure depend on many factors. These factors include:

- How much vinyl chloride a person is exposed to (dose).
- How long a person is exposed to the vinyl chloride (duration).
- How often a person is exposed to the vinyl chloride (frequency).
- How you were exposed (inhalation or drinking).

Most vinyl chloride you breathe or swallow will quickly enter your blood. When it reaches your liver, the liver will change it into other substances which also travel in your blood. Most of the vinyl chloride leaves your system through the urine within a day after entering your body. But the products made by the liver will take a little longer to leave your body.

Short-term exposure effects:

Breathing high levels of vinyl chloride (much higher than what is normally in the environment) can cause a person to feel dizzy or become sleepy. Studies in animals show that extremely high levels of vinyl chloride can damage the liver, lungs, kidneys, and heart, and prevent blood clotting.

Long-term exposure effects:

People who have breathed high levels (thousands of parts per million-ppm) vinyl chloride for several years under industrial conditions have changes in the structure of their liver. People that have worked with vinyl chloride have nerve damage and others have developed an immune reaction. Some workers exposed to very high levels of vinyl chloride have problems with the blood flow to their hands.

Are there other health problems seen with exposure to vinyl chloride?

Some men who work with vinyl chloride have complained of a lack of libido (sex drive). Women who work with vinyl chloride have reported irregular menstrual periods and have developed high blood pressure during pregnancy. Vinyl chloride has not been shown to cause birth defects.

Is there a test to find out if I have been exposed to vinyl chloride?

There are two tests which can measure vinyl chloride in your body. However, these tests are not routinely available at your doctor's office and must be done at special laboratories that have the right equipment.

Vinyl chloride can be measured in your breath and vinyl chloride's chief breakdown product, thiodiglycolic acid, can be measured in your urine. But exposure to other chemicals can also produce the same breakdown products in your urine.

Note that both the breath and urine test must be done shortly after exposure and these tests are not very helpful for measuring low levels of the chemical.

Does vinyl chloride cause cancer?

The Department of Health and Human Services (HHS) has determined that vinyl chloride is a known carcinogen (causes cancer).

The International Agency for Research on Cancer (IARC) has determined that vinyl chloride is carcinogenic (causes cancer) to humans, and the Environmental Protection Agency (EPA) has determined that vinyl chloride causes cancer.

Studies of workers who breathed very high levels vinyl chloride for many years showed an increased risk of cancers of the liver. Also, brain, lung and some cancers of the blood may also be connected with breathing vinyl chloride.

Has the federal government made recommendations to protect human health?

The federal government develops regulations and recommendations to protect public health and these regulations can be enforced by law.

The U.S. EPA requires that the amount of vinyl chloride in drinking water not exceed 0.002 ppm (parts per million).

The Food and Drug Administration (FDA) regulates the vinyl chloride content of plastics, because vinyl chloride may leak from plastic into foods or water.

Reference

The Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological profile for vinyl chloride, September, 1997.

Where can I get more information?

Ohio Department of Health
Health Assessment Section
246 N. High Street
Columbus, Ohio 43215
Phone: (614) 466-1390
Fax: (614) 466-4556



The Ohio Department of Health has a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR), Public Health Service, U.S. Department of Health and Human Services.

This pamphlet was created by the Ohio Department of Health, Health Assessment Section and supported in whole by funds from the Comprehensive Environmental Response, Compensation and Liability Act trust fund.



**Bureau of
Environmental Health
Health Assessment Section**

"To protect and improve the health of all Ohioans"

Exposure to Toxic Chemicals

Answers to Frequently Asked Health Questions

How are we exposed to chemicals?

We come in contact with many different chemicals every day that are non-toxic and normally do not cause health problems. But any chemical could become toxic if a person comes in contact with high enough doses. For example: Aspirin will cure a headache but too much aspirin becomes toxic and can cause serious health problems. You can get sick from contact with chemicals but getting sick will depend on the following:

- How much you were exposed to (dose).
- How long you were exposed (duration).
- How often you were exposed (frequency).
- General Health, Age, Lifestyle
Young children, the elderly and people with chronic (on-going) health problems are more at risk to chemical exposures.

Other factors that increase health risks are:

- Current health status (if you are ill or healthy).
- Lifestyle, age, and weight.
- Smoking, drinking alcohol, or taking certain medicines or drugs.
- Allergies to certain chemicals.
- Past chemical exposure.
- Working in an industry/factory that makes or uses chemicals.

What is a completed exposure pathway?

Chemicals must have a way to get into a person's body to cause health problems. This process of those chemicals getting into our bodies is called an exposure pathway. A completed exposure pathway includes all of the following 5 links between a chemical source and the people who are exposed to that chemical.

- (1) A Source of the chemical (where the chemical came from);
- (2) Environmental Transport (the way the chemical moves from the source to the public. This can take place through the soil, air, underground drinking water or surface water);
- (3) Point of Exposure (the place where there is physical contact with the chemical. This could be on-site as well as off-site);
- (4) A Route of Exposure (how people came into the physical contact with the chemical. This can take place by drinking, eating, breathing or touching it);
- (5) People Who Could be Exposed (people that live near a facility who are most likely to come into physical contact with the site-related chemical).

What are exposure routes?

There are three ways (routes) a person can come in contact with toxic chemicals. They include:

- Breathing (inhalation).
- Eating and drinking (ingestion).
- Skin contact (dermal contact).

Inhalation (breathing)

Chemicals can enter our body through the air we breathe. These chemicals can come in the form of dust, mist, or fumes. Some chemicals may stay in the lungs and damage lung cells. Other chemicals may pass through lung tissue, enter the bloodstream, and affect other parts of our body.

Ingestion (eating or drinking)

The body can absorb chemicals in the stomach from the foods we eat or the liquids we drink. Chemicals may also be in the dust or soil we swallow. These chemicals can enter our blood and affect other parts of our body.

Dermal (skin) Contact

Chemicals can enter our body through our skin. We can come in contact with water polluted by chemicals or touch polluted soil. Some chemicals pass through our skin and enter our bloodstream, affecting other parts of our body.

For more information contact:

Ohio Department of Health
Health Assessment Section
246 North High Street, 5th Floor
Columbus OH 43215
Phone: 614-466-1390
Fax: 614-644-4556



ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

The Ohio Department of Health is in cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR), Public Health Service, U.S. Department of Health and Human Services.

This pamphlet was created by the Ohio Department of Health, Health Assessment Section and supported in whole by funds from the Comprehensive Environmental Response, Compensation and Liability Act trust fund.



Comprehensive Cancer Program Division of Prevention

"To protect and improve the health of all Ohioans"

Cancer

Answers to Frequently Asked Health Questions

What is cancer?

Cancer is the irregular growth of abnormal cells. In the human body, normal cells grow, divide and die in a normal process. Cancer cells outlive normal cells and continue to grow and make new abnormal cells.

Cancer cells will clump together and form tumors. These tumors can invade and destroy normal cells and tissue. Tumors can be malignant (cancerous) or benign (non-cancerous).

Cancer cells can travel (metastasize) through the blood or the lymph system to other areas of the body where they can settle and form new tumors. Some cancers, such as leukemia, do not form tumors but invade the blood and blood-forming organs. Benign (non-cancerous) tumors do not spread to other parts of the body and are usually not life-threatening.

In many cases, the exact cause of cancer is not known. We know certain changes in our cells can cause cancer to start but we don't yet know exactly how this happens. Many scientists and health professionals study cancer in the hope they can discover the causes and a cure. But, there are a lot of things we **do** know about cancer.

Who gets cancer?

Cancer may strike at any age. However, cancer is mostly a disease of middle and old age. In Ohio, about 86% of cancers were diagnosed in people age 50 and older in 2000.

Cancer is the second-leading cause of death in the United States. It is estimated that half of all men and one-third of all women in the United States will develop cancer during their lifetimes.

In 2003, about 60,300 Ohioans – or 165 Ohioans per day – were diagnosed with cancer. More than 25,200 Ohioans – or about 69 people each day – died from it.

What are cancer risk factors?

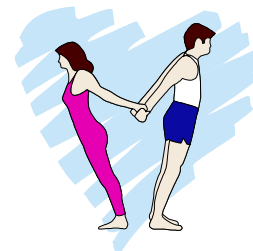
A risk factor is anything that increases a person's chance of getting a disease. Some risk factors, such as tobacco use, can be changed, and others, such as age, cannot.

Having a risk factor for cancer means a person is more likely to develop the disease at some point in his or her life. However, having one or more risk factors does not always mean a person will get cancer. Some people with one or more risk factors never develop the disease, while other people who develop cancer have no apparent risk factors. Even when a person who has a risk factor is diagnosed with cancer, there is no way to prove the risk factor actually caused the cancer. In reality, getting cancer is probably due to the combination of risk factors rather than one single factor.

Risk factors for cancer include a person's age, sex and family medical history (genetics). Other major factors are related to lifestyle choices such as using tobacco, drinking a lot of alcohol, eating a poor diet, lack of physical activity and unprotected exposure to the sun. Occupational (work) exposures can be another risk factor.

Using tobacco products, a poor diet and lack of physical activity account for about 65% of cancer deaths. Less than 5% of cancers are believed to be due to factors in the environment such as environmental pollution (2%), industrial products (1%) or food additives (1%).

The risk of developing most types of cancers can be reduced by changes in a person's lifestyle. By quitting smoking, eating healthier and exercising, you can reduce your risk of developing cancer.



Risk factors (continued)

Different kinds of cancer have different risk factors. Some of the common cancers and their risk factors include the following:

- **Lung cancer:** **Tobacco smoking is responsible for 80 to 85 percent of lung cancers.** Note: Tobacco use (including cigarettes, cigars, chewing tobacco and snuff) is also related to cancers of the mouth, larynx, cervix, bladder, kidney, esophagus and pancreas. Other important risk factors for lung cancer include exposure to radon and asbestos; a history of tuberculosis and some types of pneumonia; and family history.
- **Breast cancer** risk factors include: Increasing age; hormone-related factors such as early age at first menstruation, fewer number of pregnancies and late age at menopause; obesity; and lack of physical activity. Also, women with a mother or sister who have had breast cancer are more likely to develop the disease themselves (genetics). **All women 40 years and older should get a yearly mammogram and perform monthly self-examinations.**
- **Prostate cancer:** All men are at risk for prostate cancer. Prostate cancer is more common among African-American men compared to white men. Also, men with a father or brother who have had prostate cancer are more likely to get prostate cancer themselves (genetics). **All men 50 years and older should talk with their doctor about being tested.**
- **Colon and Rectum cancer** risk factors include: Increasing age (persons 50 years and older); a diet high in animal fat; lack of exercise; and obesity. **Women and men should be screened for colorectal cancer beginning at age 50.**
- **Skin cancer** is related to unprotected exposure to strong sunlight and severe sunburns as a child. **To protect against skin cancer use sunscreen, wear protective clothing and avoid direct sunlight between 10 a.m. and 4 p.m.**
- **Cervical cancer** risk factors include: infection with a certain sexually transmitted disease (STD) called the Human Papilloma Virus (HPV); smoking; and being HIV positive. **It is important for women to receive regular Pap tests because they can detect HPV and pre-cancerous cells.**



How is cancer treated?

Cancer is a group of diseases that behave very differently. For example, lung cancer and breast cancer develop and grow at different rates and respond to different treatments. That is why people with cancer need treatment that is aimed at their particular kind of cancer.

The patient is a vital part of his or her cancer care team. Patients and families should talk with their health care providers about which treatment choices are best. Today, millions of people are living with cancer or have been cured of the disease. **The sooner a cancer is found and the sooner treatment begins, the better a patient's chances are of a cure.** That is why early detection is such an important weapon in the fight against cancer.

Learn more about cancer:

Cancer is the second-leading cause of death among adults in Ohio following heart disease.

According to a survey released at the 11th Annual Research Conference of the American Institute for Cancer Research (AICR), cancer is the No. 1 day-to-day health concern in America. Additionally, half of all Americans believe it is impossible or next to impossible to prevent cancer. But this is not true and in many cases, cancer can be prevented.

The Ohio Department of Health wants to help Ohioans learn more about cancer, including how to prevent it, how to find it early and how to get treatment if needed.

Through coordination and working together we will make a difference in the health and quality of life in our state.

References:

American Cancer Society, <http://www.cancer.org>, 2003.

Winauer SJ, Shike M. Cancer Free: The Comprehensive Cancer Prevention Program. New York: Simon and Shuster, 1995.

Ohio Department of Health, Comprehensive Cancer Program, 2003.

American Institute for Cancer Research, July, 2001.

For more information:

If you have questions or if you need information that is not available on this fact sheet, please contact one of the following organizations:

Ohio Department of Health

(614) 728-7418

American Cancer Society

1-800-ACS-2345 or 1-800-227-2345

Ohio Radon Program

1-800-523-4439

National Cancer Institute

1-800-422-6237

Appendix C. Response to Agency and Public Comments

Government agencies and the general public were asked to review this Public Health Assessment for the New Carlisle Landfill site and provide comments and questions. The Initial/Public Comment Release, dated September 12, 2011, was made available for public comment until October 27, 2011. The document was available for public review on the Ohio Department of Health web page at <http://www.odh.ohio.gov>. Copies of the assessment were also available at the New Carlisle Public Library at 111 East Lake Avenue, New Carlisle, Ohio, 45344-1418.

Comments were received from two parties; three comments were received from the U.S. Environmental Protection Agency (USEPA) Remedial Project Manager for the New Carlisle Landfill site, and nine comments were received from the Ohio EPA Site Coordinator. No comments or questions were received from the community regarding suspected exposures or health effects from exposures from the New Carlisle Landfill site. The comments and our responses are provided below.

United States Environmental Protection Agency Comments

Submitted October 27, 2011

1. General. The PHA appears to only address the groundwater pathway. Please provide a statement to explain why the PHA has not addressed or considered other potential exposure pathways.

Response: The vapor intrusion pathway is also included in the PHA, along with the groundwater pathway, as major potential exposure pathways. Other pathways, such as the surface water pathway and the air and soil pathways were not mentioned, because they were not believed to be important. According to the Ohio EPA ESI report, no surface water intakes were identified within fifteen miles downstream of the probable point of entry, and no human receptors of surface water are present in the vicinity of the landfill. The ESI report also indicates that “There are no employees or residents living at the inactive New Carlisle Landfill. The nearest residence is approximately 300 feet east of the disposal area. The nearest school is 2 miles southeast of the landfill. No receptors of air emissions have been reported, and air migration is not considered a pathway of concern. Therefore air monitoring was not conducted.”

2. Page 2, second paragraph. Please remove or clarify the statement that the use of these wells as drinking water supplies was discontinued.

Response: Added: “The former public wells are now used for irrigation, whereas the two residential wells are inactive.”

3. Page 6, last paragraph, first sentence. Please revise the statement to clarify that the Site was added to the list of NPL sites to prevent the migration of the groundwater contamination to area residential wells.

Response: Revised the first sentence to read: “In April 2009, the New Carlisle Landfill site was added to the list of NPL sites to prevent the migration of the groundwater contamination to area residential wells (USEPA, 2008).”

Ohio Environmental Protection Agency Comments

Submitted October 27, 2011

1. Page 2, first paragraph, last sentence. Please replace the phrase “adjacent to the nursery,” with “in the vicinity of the landfill.”
Response: Replaced the phrase “adjacent to the nursery,” with “in the vicinity of the landfill” as suggested, as the landfill is the focus of the PHA.
2. Page 2, second paragraph. It is unclear why this paragraph is bolded. This sentence should be un-bolded and incorporated into the paragraph above.
Response: As suggested, the sentence regarding the two public wells and the two on-site private wells at the nursery were un-bolded and incorporated into the first paragraph of the Summary section.
3. Page 5, next step bullets for vapor intrusion evaluation. Another bullet should be added to address potential vapor intrusion from the landfill and groundwater contamination closer to the site. The assessment should recommend that the remedial investigation should include a vapor intrusion investigation for buildings closer to the landfill, particularly the residences and commercial building on the landfill property.
Response: Added as a bullet to Next Steps under the third Conclusion: “The vapor intrusion pathway should be investigated further for residences and the commercial building on the landfill property and for buildings near the landfill.”
4. Page 7, Site Location. Please add to this paragraph the additional detail that there are two residences and a business located on the landfill property. The residences and business are located east to the land filled area along State Route 235. The business, located at the northeast corner of the site, is currently a used car lot.
Response: Added: “There are two residences and a business located on the landfill property. The residences and business are located east to the land filled area along State Route 235. The business, located at the northeast corner of the site, is currently a used car lot (Ohio EPA, personal communication, October 27, 2011).”
5. Page 8, Land Use. Please add to this paragraph mention of the used car lot business located on the site property. Previous businesses at this location may have also included auto repair services. Also, add to this paragraph mention the commercial properties located southeast of the site. These properties, located east of the nursery, on the east side of State Route 235, currently include a vacant YMCA building, a day care, and a social services provider.
Response: Added to Land Use section: “A used car lot is located on the site property, and previous businesses at this location may also have included auto repair services. There are also commercial properties located southeast of the site, located east of the nursery on the east side of State Route 235, and currently include a vacant YMCA building, a day care, and a social services provider (Ohio EPA, personal communication, October 27, 2011).”
6. Page 9, Groundwater Investigation. Please add to this paragraph mention that during the SI Investigation, the eight residential wells sampled included the two residential wells on the landfill property, and that these two wells did not have any detections for volatile organic

compounds.

Response: Added to Groundwater Investigations: “During the SI Investigation, two residential wells out of the eight residential wells sampled were on the landfill property. These two wells did not show detections of volatile organic compounds (Ohio EPA, personal communication, October 27, 2011).”

7. Page 11, last paragraph. The last sentence is out of place and should be deleted from this paragraph. It refers to the 2005 sample results from within the landfill and is already included as the last sentence of the second paragraph on this page.

Response: Deleted the duplicate sentence under the Additional Groundwater Data section.

8. Page 14, third paragraph. This paragraph discusses the potential for vapor intrusion exposure to workers at the landfill. To this discussion, add the potential for vapor intrusion to on-property residents and business. Also add mention of the potential explosive risks from landfill gases, such as methane, at the on-site residences and business. The assessment should recommend that a landfill gas investigation be included in the upcoming remedial investigation for the site.

Response: Added: “There could be potential exposure from vapor intrusion to the on-property residents and business. In addition, there could be potential explosive risks from landfill gases, such as methane, at the on-site residences and business.”

9. Page 20, Recommendations, second bullet. The last sentence of this bullet should be reconsidered. The sentence states that “contaminants in the groundwater at the site have been documented to move quickly...” However, it is difficult to distinguish whether the changing vinyl chloride concentrations in the New Public Well are due to the plume migrating or are changing due to influence from pumping of that well, which is used for irrigation, so it cannot be inferred from the increasing concentrations in the New Public Well that the plume is continuing to migrate and that down gradient wells are at great risk. However, continued monitoring of the plume and down gradient wells is necessary and will be conducted as part of the upcoming remedial investigation for the site.

Response: Removed sentence that states “contaminants in the groundwater at the site have been documented to move quickly.” Added to Conclusion 2: “Testing recently conducted on October 24, 2011 by the Clark County Combined Health District of the four down gradient private wells indicated no VOCs. It is uncertain whether or not the plume is continuing to migrate and that down gradient wells are at risk. Continued monitoring of the plume and down gradient wells is necessary and will be conducted as part of the upcoming remedial investigation for the site.” It is recommended that the down gradient wells be continued to be monitored.